WYOMING STATE GEOLOGICAL SURVEY
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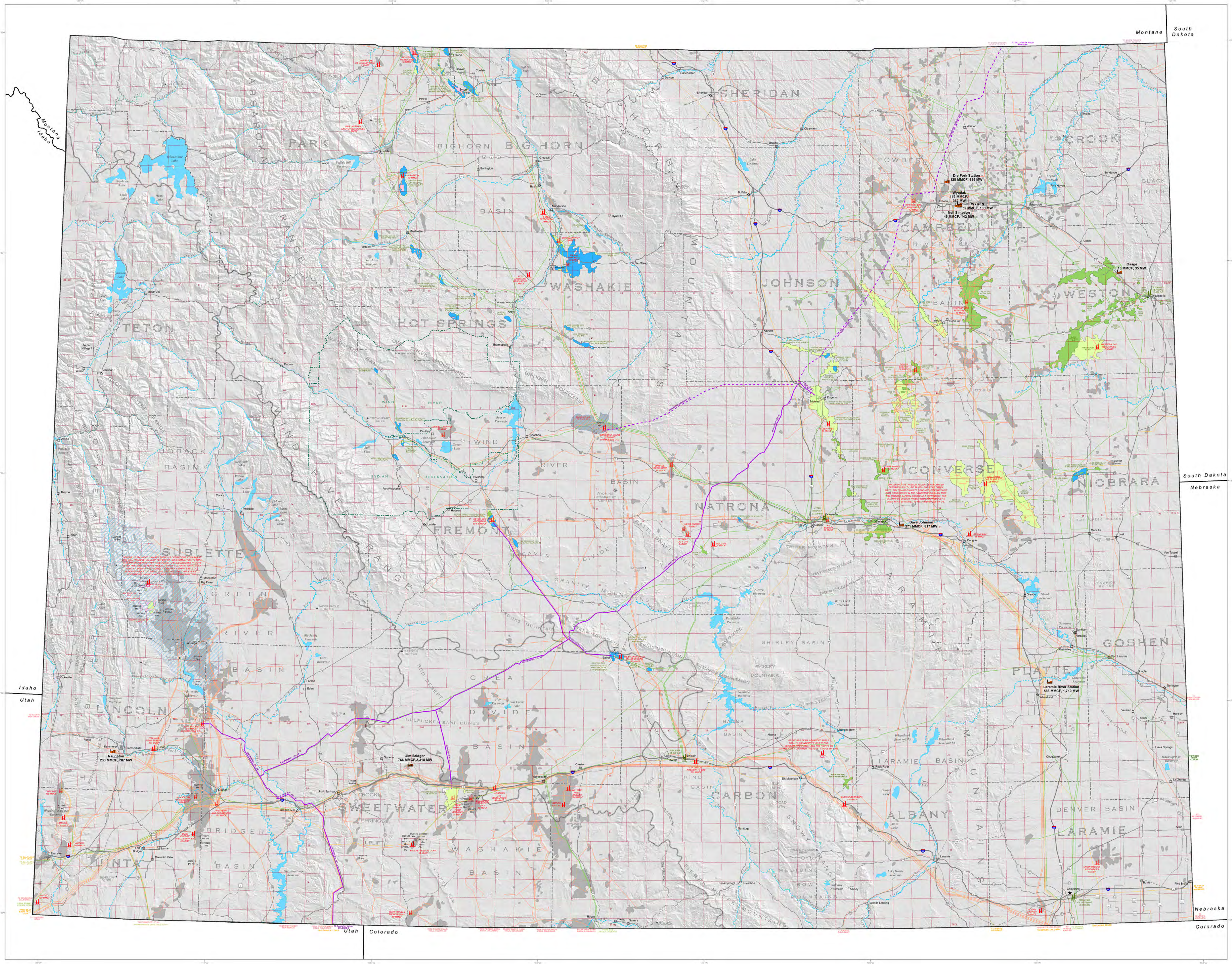
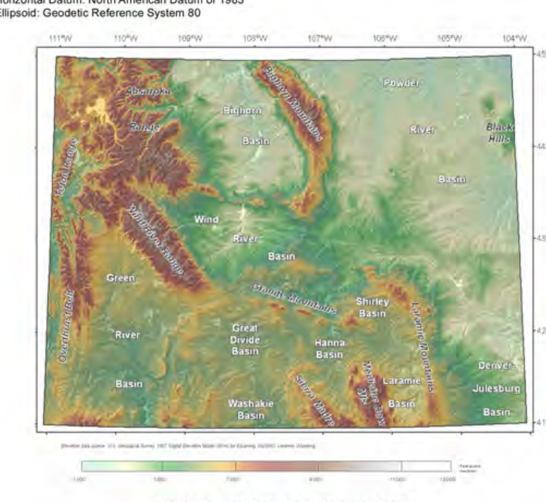
Geology - Interpreting the past - Providing for the future

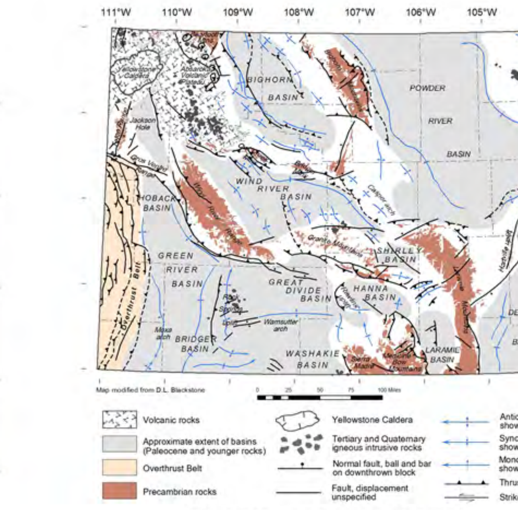
MAP SERIES 90
WYOMING CARBON DIOXIDE MAP



Map Projection: Lambert conformal conic
False Easting: 500000, False Northing: 200000
Central Meridian: -107.5 degrees West
Standard Parallel 1: 41 degrees North
Standard Parallel 2: 45 degrees North
Latitude of Origin: 41 degrees North
Linear Unit: Meter
Horizontal Datum: North American Datum of 1983
Ellipsoid: Geodetic Reference System 80



DIGITAL ELEVATION MODEL OF INTERMONTANE BASINS OF WYOMING



STRUCTURAL MAP OF WYOMING

Magnetic Declination = 10° 37.5' East (May 19, 2011)

CHIEF WASHAKIE

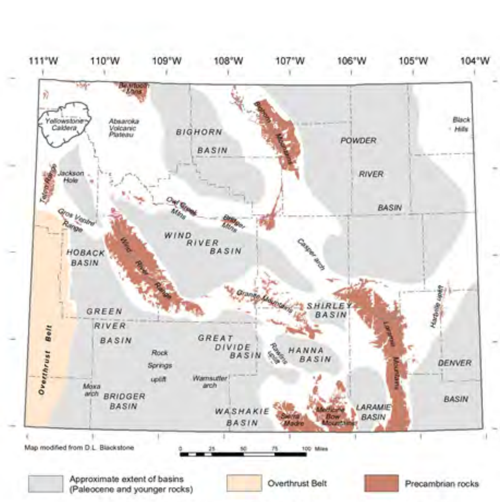
Scale 1:500,000
1 inch equals approximately 8 miles (13 kilometers)
1 centimeter equals approximately 5 kilometers (3 miles)

CARBON DIOXIDE (CO_2) MAP OF WYOMING

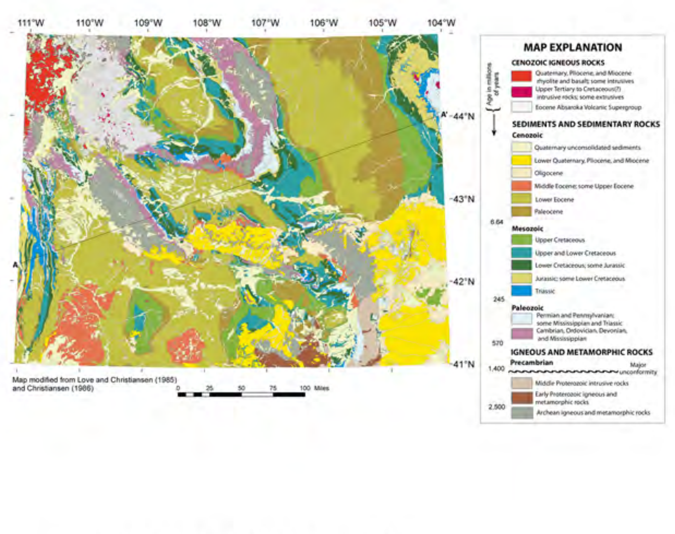
SHOWING MAJOR PIPELINES AND OIL FIELDS THAT ARE TARGETS FOR ENHANCED OIL RECOVERY USING CO_2

by
Rodney H. De Bruin
2012

WYOMING STATE GEOLOGICAL SURVEY



BASINS AND UPLIFTS MAP OF WYOMING



GENERAL GEOLOGY MAP OF WYOMING

EXPLANATION

In 2009 Wyoming produced 41,954 million kilowatt hours (KWH) of electricity and 49. 3 million short tons of CO_2 related to electrical generation from coal -fired plants. (Energy Information Association, http://www.eia.doe.gov/)

On the basis of 2009 production capacity, we can assign million tons/yr and MMCF/day of CO_2 emissions to Wyoming coal-fired plants:

Plant	Megawatts (MW)	Percent Production	Million Tons of CO2/YR	Billion Cubic Feet per Year (BCF/YR)	Million Cubic Feet Per Day (MMCF/Day)
Jim Bridger	2,318	34.8	17.2	279.7	766
Laramie River	1,710	25.7	12.7	206.5	566
Dave Johnston	817	12.3	6.1	98.8	271
Naughton	707	10.6	5.2	85.2	233
Dry Fork Station	385	5.8	2.9	46.6	128
Wyodak	362	5.4	2.6	43.4	119
WYGEN	183	2.7	1.3	21.7	59
Neal Simpson	142	2.1	1.0	16.9	46
Osage	35	0.6	0.3	4.8	13
Totals	6,659	100	49.3	803.6	2201

PIPELINES

Notation includes operator and pipe diameter in inches; proposed pipelines are dashed. Pipeline routes are plotted as accurately as possible and are only accurate within the scale of this map or maps of smaller scale. Most infield gathering systems are not shown.

- CHEVRON CO_2 16" — Carbon dioxide
- Crude oil
- Natural gas
- Refinery or natural gas processing plant products

FIELDS

New fields are spotted through September, 2008. Field boundaries are approximate.

- Carbon dioxide (CO_2) producing fields. Modified after Stilwell, 1989; from De Bruin (1991)
- Names in green denote fields that primarily produce oil, had at least 50 million barrels of original oil in place (OOIP), and are candidates for or are currently undergoing enhanced oil recovery (EOR) using CO_2. These fields may produce significant associated natural gas along with the oil in the primary reservoir or nonassociated natural gas from secondary reservoirs
- Oil and gas fields
- Wells testing high in CO_2

PREDOMINANT AGE OF CARBON DIOXIDE FLOOD CANDIDATE RESERVOIR ROCKS

- TERTIARY
- UPPER CRETACEOUS
- LOWER CRETACEOUS
- JURASSIC-TRIASSIC
- PERMIAN-PENNSYLVANIAN
- MISSISSIPPIAN-DEVONIAN-ORDOVICIAN-CAMBRIAN-PRECAMBRIAN

FIELD DESIGNATIONS

(AIR)	Air injection project
(CD)	Carbon dioxide flood
(CM)	Coalbed methane
(D)	Produced water disposal project
(G)	Gas injection project
(GD)	Gas disposal
(H)	Hydrothermal (steam) injection project
(HD)	Horizontal drilling project
(HO)	Heavy oil–less than 20°API gravity
(HS)	Hydrogen sulfide
(S)	Gas or LPG storage
(SI)	Shut-in field
(T)	Tertiary recovery project
(W)	Waterflood project

Note: These designations appear after the oil or gas field name

SYMBOLS AND DESIGNATIONS

- Laramie River Station 566 MMCF, 1,710 MW — Coal-fired power plant. Notation includes plant name, carbon dioxide (CO_2) production in million cubic feet (MMCF) per day and electrical production in megawatts (MW)
- SINCLAIR 54,000 B/D — Oil refinery that emits CO_2. Notation includes operator and capacity in barrels of oil per day (B/D). Locations approximate
- DEVON ENERGY 50 MMCF — Natural gas processing plant. Notation includes operator and capacity in million cubic feet (MMCF) per day. Locations approximate
- EXXONMOBIL 670 MMCF 400 MMCF/DAY CO_2 — Natural gas processing plant that produces major amounts of CO_2. Notation includes operator and capacity in million cubic feet (MMCF) per day. Locations approximate

LIST OF OIL AND GAS PRODUCING GROUPS, FORMATIONS, AND MEMBERS

Both abandoned and currently producing formations are shown for each field. On map, formations from which heavy oil is produced are enclosed in parentheses, e.g., (Kf); formations from which significant hydrogen sulfide is produced are enclosed in brackets, e.g., [Mm].

TERTIARY
- Twk Knight Formation[1]
- Ta Almy Formation[1]
- Twr White River Formation
- Tw Wasatch Formation
- Twdr Wind River Formation
- Tgr Green River Formation
- Tfu Fort Union Formation
- Th Hanna Formation

UPPER CRETACEOUS
- Kl Lance Formation
- Kfh Fox Hills Sandstone
- Kle Lewis Shale
- Kme Meeteetse Formation
- Kmv Mesaverde Formation (or Group)
- Kad Adaville Formation
- Kmvt Teapot Sandstone
- Kmvp Parkman Sandstone
- Kal Almond Formation
- Ke Ericson Sandstone
- Krs Rock Springs Formation
- Kbl Blair Formation
- Kh Hilliard Shale
- Kba Baxter Shale
- Ksx Sussex Sandstone
- Ksh Shannon Sandstone
- Kc Cody Shale
- Ks Steele Shale
- Kn Niobrara Formation
- Ktr Turner Sandstone[1]
- Kg Greenhorn Formation
- Kbf Belle Fourche Shale
- Kcd Codell Sandstone
- Kf Frontier Formation
- Kmr Mowry Shale
- Ka Aspen Shale

LOWER CRETACEOUS
- Knc Newcastle Sandstone
- Kmd Muddy Sandstone
- Kbr Bear River Formation
- Kcv Cloverly Formation
- Ksc Skull Creek Shale
- Kd Dakota Sandstone[1]
- Kfr Fall River Formation
- Kla Lakota Formation

CRETACEOUS-JURASSIC
- KJg Gannett Group

JURASSIC
- Jm Morrison Formation
- Jtc Twin Creek Limestone
- Js Sundance Formation

JURASSIC-TRIASSIC
- JTRn Nugget Sandstone

TRIASSIC
- TRa Ankareh Formation
- TRt Thaynes Limestone
- TRcm Crow Mountain Sandstone (or Sandstone Member)
- TRc Chugwater Formation or Group
- TRca Alcova Limestone
- TRcr Red Peak Formation (or Member)
- TRw Woodside Shale
- TRd Dinwoody Formation

PERMIAN
- Pm Minnekahta Limestone
- Pp Phosphoria Formation

PERMIAN-PENNSYLVANIAN
- PPc Casper Formation
- PPml Minnelusa Formation

PENNSYLVANIAN
- IPm Morgan Formation
- IPw Weber Sandstone
- IPt Tensleep Sandstone

PENNSYLVANIAN-MISSISSIPPIAN
- IPMa Amsden Formation

MISSISSIPPIAN
- Md Darwin Sandstone
- Mm Madison Limestone

DEVONIAN
- Dj Jefferson Formation
- Dd Darby Formation

ORDOVICIAN
- Obh Bighorn Dolomite

CAMBRIAN
- €gv Gros Ventre Formation
- €f Flathead Sandstone

PRECAMBRIAN
- p€ Archean and Proterozoic Rocks undivided

[1]Formation name extended from neighboring states, not formally recognized in Wyoming, or not commonly used in Wyoming

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Basin axes and boundary thrust faults: De Bruin (1996).

Digital cartography: Joseph M. Huss
Map layout: Robin W. Lyons
Map editing: Suzanne C. Luhr

BASE MAP EXPLANATION

Landforms
- Point of interest
- Mountain peak
- Geographic center of Wyoming (calculated centroid)

Cities
- State capital
- County seat
- Town

Roads
- Interstate highway
- US highway
- State highway
- County or other road
- Railroad

Boundaries
- Continental Divide
- County boundary
- Indian reservation boundary

Water
- River
- Lake or reservoir

BASE MAP SOURCES

Cities layer: Spatial Data and Visualization Center, "Cities, Towns, Census Designated Places of Wyoming at 1:100,000" [based on U.S. Census Bureau information, 1996], *at* http://resources.wygisc.org/arcgis/services/

Continental Divide boundary layer: A subset of the Wyoming gap analysis land ownership and management status dataset, developed at 1:100,000 scale for Wyoming.

County boundaries layer: Spatial Data and Visualization Center, "Internet Mapping Service: Basemap Data for Wyoming," *at* http://resources.wygisc.org/arcgis/services/

Magnetic declination: Calculated from NOAA National Geophysical Data Center, *at* http://www.ngdc.noaa.gov/geomagmodels/struts/calcDeclination

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